

Unit 7.2. MCQs Set 1

Results



#1. Q1. In comparing plant and animal cells, which statement is correct?

- (A). Both lack membrane-bound organelles
- (B). Only plant cells have mitochondria, animal cells do not
- (C). Plant cells contain a cell wall (cellulose), chloroplasts for photosynthesis, large central vacuole; animal cells typically lack these
- (D). Both contain chloroplasts by default

Plant cells have a rigid cell wall, chloroplasts for photosynthesis, and a large central vacuole, features that animal cells generally lack.

#2. Q2. Early experiments proving DNA as genetic material included:

- (A). Morgan's fruit fly crosses
- (B). Griffith's transformation experiment with *Streptococcus pneumoniae*, followed by Avery-MacLeod-McCarty and Hershey-Chase experiments
- (C). Meselson-Stahl experiment only
- (D). None

Griffith's experiment showed the transforming principle, Avery-MacLeod-McCarty identified it as DNA, and Hershey-Chase confirmed DNA's role in heredity.

#3. Q3. Chemistry of nucleic acids reveals each nucleotide has:

- (A). Amino acids, methyl groups, sulfate
- (B). A phosphate group, a sugar (ribose or deoxyribose), and a nitrogenous base
- (C). Only lipids



- (D). None

Each nucleotide is made up of a phosphate group, a sugar (ribose in RNA or deoxyribose in DNA), and a nitrogenous base.

#4. Q4. Chargaff's rule states that in DNA,

- (A). A = G always

(B). A + T = C + G

(C). %A = %T and %G = %C

(D). None

Chargaff's rule shows that in double-stranded DNA, the amount of adenine equals thymine, and guanine equals cytosine.

#5. Q5. The Watson-Crick model of DNA proposed

- (A). A triple helix structure

(B). A double-stranded helix with antiparallel strands, bases paired A-T and G-C

(C). None

(D). No hydrogen bonds

The Watson-Crick model describes a double helix with complementary base pairing and antiparallel strands.

#6. Q6. DNA can have different forms (A, B, Z). The "B-form" is

- (A). Most common physiological form, right-handed helix

(B). Left-handed helix

(C). None

(D). Single-stranded in cells

B-DNA is the most common form found under physiological conditions; it is a right-handed helix.

#7. Q7. Types of RNA do not include

- (A). mRNA, tRNA, rRNA

(B). siRNA, miRNA, snRNA

(C). RBC doping

(D). None

'RBC doping' is not a type of RNA; all others are recognized classes of RNA.

#8. Q8. Concept of a "gene" historically means

- (A). None



- (B). A unit of inheritance controlling a trait, eventually known as a DNA segment coding for a functional product
- (C). RBC doping
- (D). Infectious illusions

Historically, a gene is considered a unit of heredity that governs a trait, later identified as a DNA segment coding for a product.

#9. Q9. The difference between prokaryotic and eukaryotic genes typically is that

- (A). None
- (B). Eukaryotic genes often have introns, promoters/enhancers, while prokaryotic genes are mostly contiguous coding regions
- (C). RBC doping
- (D). Infectious illusions

Eukaryotic genes contain introns and complex regulatory elements, unlike most prokaryotic genes which are continuous.

#10. Q10. The “C-value paradox” addresses

- (A). None
- (B). The lack of correlation between organismal complexity and genome size
- (C). RBC doping
- (D). Infectious illusions

The C-value paradox refers to the observation that genome size does not consistently correlate with an organism's complexity.

#11. Q11. Triplexes, quadruplexes, and aptamers refer to

- (A). None
- (B). Non-canonical DNA/RNA structures (e.g., triple-stranded DNA, G-quadruplexes, aptamer folding)
- (C). RBC doping
- (D). Infectious illusions

These terms denote unusual structural conformations in nucleic acids beyond the classical double helix.

#12. Q12. DNA replication: the semi-conservative model was confirmed by

- (A). Griffith's transformation
- (B). Meselson-Stahl experiment
- (C). None
- (D). RBC doping



The Meselson-Stahl experiment demonstrated that each new DNA molecule consists of one old and one new strand, supporting the semi-conservative model.

#13. Q13. The “dispersive model” of replication was disproven because

- (A). None
- (B). Meselson-Stahl’s results showed a pattern consistent with semi-conservative replication
- (C). RBC doping
- (D). Infectious illusions

The experimental results did not support the dispersive model, but were in line with semi-conservative replication.

#14. Q14. DNA replicative enzymes do not include

- (A). Helicase
- (B). DNA polymerase
- (C). Min. synergy
- (D). DNA ligase

‘Min. synergy’ is not an enzyme; helicase, DNA polymerase, and DNA ligase are involved in replication.

#15. Q15. Mechanism of DNA replication in prokaryotes involves

- (A). None
- (B). A single origin of replication (OriC) with bidirectional replication forks
- (C). RBC doping
- (D). Infectious illusions

Prokaryotic chromosomes typically replicate from a single origin with bidirectional forks.

#16. Q16. Types of gene mutations: “base substitution” can be

- (A). Missense, nonsense, or silent
- (B). None
- (C). RBC doping
- (D). Infectious illusions

Base substitution mutations can result in a missense change (different amino acid), a nonsense mutation (stop codon), or a silent mutation (no amino acid change).

#17. Q17. Frameshift mutation arises from

- (A). None



- (B). Insertion or deletion of nucleotides not in multiples of three, causing a shift in the reading frame
- (C). RBC doping
- (D). Infectious illusions

Frameshift mutations disrupt the reading frame of the gene, potentially altering all downstream codons.

#18. Q18. DNA damage and repair mechanisms: “nucleotide excision repair” deals with

- (A). None
- (B). Removal of bulky lesions such as thymine dimers and replacement with correct nucleotides
- (C). RBC doping
- (D). Infectious illusions

Nucleotide excision repair specifically targets bulky, helix-distorting lesions in DNA.

#19. Q19. Gene expression in prokaryotes typically features

- (A). None
- (B). Polycistronic mRNA, a single RNA polymerase, and no introns
- (C). RBC doping
- (D). Infectious illusions

Prokaryotic genes are usually organized in operons and transcribed into polycistronic mRNA without introns.

#20. Q20. The structure of a typical prokaryotic gene includes

- (A). None
- (B). A promoter (with -35 and -10 regions), an operator or regulatory sequence, and a continuous coding region
- (C). RBC doping
- (D). Infectious illusions

Prokaryotic genes are generally uninterrupted and are regulated by nearby promoter and operator sequences.

#21. Q21. Prokaryotic RNA polymerase has subunits

- (A). None
- (B). α_2 , β , β' , and σ factor for initiation
- (C). RBC doping
- (D). Infectious illusions

The core enzyme is composed of α , β , and β' subunits and the σ factor is necessary for promoter recognition during initiation.



#22. Q22. Mechanism of gene transcription includes

- (A). None
- (B). Initiation at the promoter, elongation (5'→3' synthesis), and termination at specific signals
- (C). RBC doping
- (D). Infectious illusions

Transcription proceeds in three phases: initiation, elongation, and termination.

#23. Q23. Translation: the genetic code

- (A). None
- (B). Is read in triplets (codons), each specifying an amino acid or a stop signal
- (C). RBC doping
- (D). Infectious illusions

The genetic code is read in codons, where each triplet corresponds to a specific amino acid or a termination signal.

#24. Q24. Gene structure in eukaryotes typically

- (A). None
- (B). Consists of exons and introns with promoter elements like the TATA box, requiring splicing of pre-mRNA
- (C). RBC doping
- (D). Infectious illusions

Eukaryotic genes contain introns and exons; introns are removed during RNA splicing to form mature mRNA.

#25. Q25. RNA polymerases in eukaryotes:

- (A). None
- (B). RNA Pol I synthesizes rRNA, RNA Pol II synthesizes mRNA, and RNA Pol III synthesizes tRNA (and some rRNA)
- (C). RBC doping
- (D). Infectious illusions

Eukaryotic cells use three distinct RNA polymerases with specific roles in RNA synthesis.

#26. Q26. Post-transcriptional modifications in eukaryotes include

- (A). None
- (B). Addition of a 5' cap, addition of a 3' poly-A tail, and splicing of pre-mRNA
- (C). RBC doping
- (D). Infectious illusions



Eukaryotic pre-mRNA undergoes several modifications before translation, including capping, polyadenylation, and splicing.

#27. Q27. The Operon concept (e.g., lac operon) in prokaryotes exemplifies

- (A). None
- (B). A cluster of genes under a single promoter that is regulated collectively by a repressor or activator
- (C). RBC doping
- (D). Infectious illusions

The lac operon is a classic model of gene regulation in prokaryotes, where multiple genes are co-regulated.

#28. Q28. Basic concepts of Genetic Engineering might involve

- (A). None
- (B). Recombinant DNA technology, use of plasmids, restriction enzymes, DNA ligase, and transformation techniques
- (C). RBC doping
- (D). Infectious illusions

Genetic engineering relies on tools like restriction enzymes and vectors to manipulate DNA.

#29. Q29. Restriction enzymes in molecular biology are

- (A). None
- (B). Enzymes that cut DNA at specific palindromic sequences
- (C). RBC doping
- (D). Infectious illusions

Restriction enzymes cleave DNA at defined sequences, typically palindromic regions.

#30. Q30. DNA ligase

- (A). None
- (B). Joins Okazaki fragments during replication and seals nicks in recombinant DNA molecules
- (C). RBC doping
- (D). Infectious illusions

DNA ligase forms phosphodiester bonds between adjacent DNA fragments during replication and in recombinant DNA constructs.

#31. Q31. Plasmid vectors generally contain

- (A). None
- (B). An origin of replication, a selectable marker, and a multiple cloning site



-
- (C). RBC doping
-
- (D). Infectious illusions

Plasmid vectors are engineered to include essential elements for replication and selection within host cells.

#32. Q32. Transformation in cloning means

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- (A). None
-
- (B). The introduction of a recombinant plasmid into bacteria, which then become transformants
-
- (C). RBC doping
-
- (D). Infectious illusions

Transformation is the process where competent bacterial cells take up recombinant plasmid DNA.

#33. Q33. Early evidence for DNA as genetic material: Avery, MacLeod, and McCarty showed

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- (A). None
-
- (B). DNA from virulent bacteria could transform non-virulent strains
-
- (C). RBC doping
-
- (D). Infectious illusions

Their experiments demonstrated that DNA, not protein, was responsible for transforming bacterial phenotypes.

#34. Q34. Hershey-Chase used radioisotopes

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- (A). None
-
- (B). ^{32}P labeled DNA and ^{35}S labeled protein; only the ^{32}P label entered bacterial cells, proving DNA is the hereditary material
-
- (C). RBC doping
-
- (D). Infectious illusions

The Hershey-Chase experiment confirmed that DNA is the genetic material as only the radiolabeled DNA entered the bacterial cells.

#35. Q35. Nucleic acids' "phosphodiester bond" is between

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- (A). None
-
- (B). The 3'-OH of one sugar and the 5'-phosphate of the next nucleotide
-
- (C). RBC doping
-
- (D). Infectious illusions

The phosphodiester bond connects the 3' hydroxyl group of one nucleotide to the 5' phosphate group of the next, forming the backbone of DNA and RNA.



#36. Q36. The “semi-discontinuous” replication in eukaryotes refers to

- (A). None
- (B). Continuous synthesis of the leading strand and discontinuous synthesis (Okazaki fragments) of the lagging strand
- (C). RBC doping
- (D). Infectious illusions

During replication, the leading strand is made continuously while the lagging strand is synthesized in short segments.

#37. Q37. Proofreading during DNA replication is mainly performed by

- (A). None
- (B). The 3'→5' exonuclease activity of DNA polymerase
- (C). RBC doping
- (D). Infectious illusions

DNA polymerase's 3'→5' exonuclease activity removes misincorporated nucleotides during replication.

#38. Q38. DNA mismatch repair system fixes

- (A). None
- (B). Base-base mismatches left after replication if proofreading fails
- (C). RBC doping
- (D). Infectious illusions

The mismatch repair system identifies and corrects errors that escape the proofreading activity of DNA polymerase.

#39. Q39. Transcription in eukaryotes vs. prokaryotes differs because eukaryotes

- (A). None
- (B). Have three nuclear RNA polymerases and extensive post-transcriptional modifications such as splicing, 5' capping, and 3' polyadenylation
- (C). RBC doping
- (D). Infectious illusions

Eukaryotic transcription is more complex due to the presence of multiple RNA polymerases and mRNA processing events.

#40. Q40. Translation in prokaryotes can initiate even before transcription ends because

- (A). None
- (B). They lack a nuclear membrane, allowing transcription and translation to be coupled
- (C). RBC doping
-



(D). Infectious illusions

In prokaryotes, the absence of a nuclear envelope permits simultaneous transcription and translation.

#41. Q41. The genetic code is “degenerate” meaning

- (A). None
- (B). Multiple codons can encode the same amino acid
- (C). RBC doping
- (D). Infectious illusions

Degeneracy of the genetic code means that there is redundancy, with several codons capable of coding for the same amino acid.

#42. Q42. Post-transcriptional modifications in eukaryotes do not include

- (A). None
- (B). 5' capping
- (C). 3' poly-A tail
- (D). Removal of exons

(D)
Exons are retained in the mature mRNA; instead, introns are removed during RNA processing.

#43. Q43. The lac operon is induced in E. coli when

- (A). None
- (B). Lactose is present, binding to the repressor and permitting transcription of the lac genes
- (C). RBC doping
- (D). Infectious illusions

When lactose is available, it binds to the lac repressor, lifting repression and allowing the operon to be transcribed.

#44. Q44. Basic concept in Genetic Engineering: “Cloning vector” must have

- (A). None
- (B). An origin of replication, a selectable marker, and a unique multiple cloning site (MCS)
- (C). RBC doping
- (D). Infectious illusions

A cloning vector requires these elements to successfully propagate and select for inserted DNA in host cells.



#45. Q45. "Competent cells" are

- (A). None
- (B). Bacterial cells that have been treated (e.g., with CaCl_2) or electroporated to enable DNA uptake
- (C). RBC doping
- (D). Infectious illusions

Competent cells are prepared to be permeable to DNA, facilitating the transformation process.

#46. Q46. Restriction-fragment length polymorphism (RFLP) analysis:

- (A). None
- (B). Variation in DNA sequences causes differences in restriction enzyme cutting patterns, used for genetic mapping or forensic analysis
- (C). RBC doping
- (D). Infectious illusions

RFLP analysis relies on variable fragment lengths due to differences in DNA sequence and restriction enzyme recognition sites.

#47. Q47. PCR (Polymerase Chain Reaction) key steps are

- (A). None
- (B). Denaturation, annealing, and extension
- (C). RBC doping
- (D). Infectious illusions

PCR amplifies DNA by cycling through denaturation, annealing of primers, and extension by DNA polymerase.

#48. Q48. Southern blot is used to

- (A). None
- (B). Detect specific DNA fragments after gel electrophoresis by hybridizing with a labeled probe
- (C). RBC doping
- (D). Infectious illusions

Southern blotting involves transferring separated DNA fragments to a membrane and hybridizing with a specific probe to detect a target sequence.

#49. Q49. Gene expression regulation in eukaryotes can occur at

- (A). None
- (B). Multiple levels such as transcription initiation, RNA processing, mRNA transport/stability, translation, and post-



translational modifications

(C). RBC doping

(D). Infectious illusions

Eukaryotic gene expression is highly regulated at several steps from transcription to translation and post-translational modification.

#50. Q50. Biotechnology example: producing insulin by

(A). None

(B). Cloning the human insulin gene into a bacterial expression system and purifying recombinant insulin

(C). RBC doping

(D). Infectious illusions

Recombinant insulin is produced by inserting the human insulin gene into bacteria (or yeast), expressing the protein, and purifying it.

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